Customized error clustering of industrial surface inspection images

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In industrial quality control the optical surface inspection of the produced items frequently plays an important role. The typical aim of industrial visual inspection is to determine whether the produced item meets certain requirements or contains errors. In our particular dataset, due to the nature of the errors and the special properties of the construction of the surface inspection images, the error-regions in most cases are not connected any more.

The goal of our study is to provide a clustering process that finds reasonable grouping of the disconnected error regions, such that the inspection of these images can be automated. By leaving out the human supervision, we can reduce the uncertainty and inconsistency, and accelerate the inspection. Furthermore, our aim was to find a computationally efficient method that does not require high level domain knowledge and is able to extract the required information only from the analyzed images themselves.

We set up a clustering pipeline, select the proper methods for preprocessing, experiment with several available clustering methods (SLINK [1], DBSCAN [2], TURN [3], CTS [4], etc.) and observe the possibilities of the automation of parameter selection. We evaluate the clustering methods with the aid of external validity indices, but we also propose an internal validity index for the case when no ground truth is available [5].

References

[1] K. Florek, J. Łukaszewicz, and Perkal, J and Steinhaus, Hugo and Zubrzycki, S. Sur la liaison et la division des points d'un ensemble fini. In Colloquium Mathematicae, volume 2, pages 282285. Institute of Mathematics Polish Academy of Sciences, 1951.

[2] Martin Ester, Hans peter Kriegel, Jörg S, and Xiaowei Xu. A density-based algorithm for discovering clusters in large spatial databases with noise. pages 226231. AAAI Press,1996.

[3] Andrew Foss and Osmar R. Zaïane. A parameterless method for efficiently discovering clusters of arbitrary shape in large datasets. In ICDM, pages 179186. IEEE Computer Society, 2002.

[4] Ana LN Fred and Anil K Jain. Data clustering using evidence accumulation. In Pattern Recognition, 2002. Proceedings. 16th International Conference on, volume 4, pages 276 280. IEEE, 2002.

[5] Maria Halkidi, Yannis Batistakis, and Michalis Vazirgiannis. On clustering validation techniques. Journal of Intelligent Information Systems, 17:107145, 2001.